Regional e-Notes ~ January 2012 Vol 4, Issue 1

Letter from the Director

Aloha & Happy New Year,

We are off to a great start this year at CTSA! In addition to managing our ongoing projects, we are gearing up to bring the industry more initiatives, projects, and publications as our Center evolves, so stay tuned.

On a similar note, it is about this time each year that we begin to think about funding priorities for our next development cycle. In preparation for CTSA's FY12 development process, we are requesting your input on potential research priorities. Perhaps start by answering the following questions...*what do you need from CTSA to make your industry more profitable? What challenges are your industry facing?*

To submit a suggestion, please email Information Specialist Meredith Brooks (mbrooks@oceanicinstitute.org) or me (cslee@oceanicinstitute.org). Please keep in mind that we are striving to fund projects that make measurable impacts to both the industry and community.

As always, if you have any questions, concerns, or comments, please feel free to share them with our team.

Mahalo,

Cheng-Sheng Lee
Executive Director, CTSA

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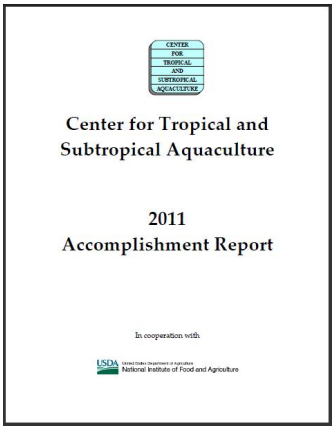
CTSA Annual Accomplishment Report



As 2012 begins, we would like to take time to assess achievements from 2011 and highlight research reported in our recently published Annual Accomplishment Report. Since its inception in 1986, CTSA has funded 231 research, demonstration, development, and extension projects. Of the 23 projects active in 2011, the three summarized below reached completion.

Efforts of the project "Developing Bivalve Culture to Diversify and Position Hawaii as a Supplier of Safe, Premium, Edible Shellfish Products, Years 1 and 2" focused on resolving issues that have historically impeded growout of edible bivalves in Hawaii. Under the auspices of this project led by Dr.'s Bob Howerton and Maria Haws, the work group demonstrated the biological feasibility of edible bivalve culture, identified steps necessary for the certification of a laboratory in Hawaii, and is still addressing these steps. The project also made significant advances to build capacity for Hawaiian fishpond operators to grow shellfish in coastal areas. Researchers identified multiple species as potential culture candidates. There are potentially at least 2-dozen bivalve species that could be good aquaculture candidates, foremost among them the clams. In addition, the Hawaiian oyster, Dendrostrea sandvichensis, was successfully spawned fifteen times with

larvae numbers ranging from 10,000 to 50,000. Growout trials proved the viability of the species in aquaculture. Despite cooperation between DOH and FDA to certify a laboratory in Hawaii, due to the current fiscal challenges for the State of Hawaii, this continues to be the largest bottleneck to the development of a viable commercial bivalve industry for the State. The project work group is facilitating further discussion with the DOH and FDA to move the certification forward.

The goal of the completed project "Improving the Hatchery Output of the Hawaiian Pink Snapper (Pristipomoides filamentosus)," led by Dr. Clyde Tamaru, was to develop and transfer hatchery and nursery techniques for the production of opakapaka juveniles that meet commercial-scale requirements. The project group conducted a series of laboratory-scale rearing trials to investigate first feeding, during which they gained the knowledge that rotifers do not appear to be a suitable transitional live food organism for opakapaka, and that the first feeding of opakapaka larvae can be achieved using copepod nauplii, resulting in high survival up to 10-14 days post hatching. While there were no major impacts with regard to an overall improvement of the hatchery technologies being developed for the opakapaka, an impact of another nature was realized when the graduate student working on the project obtained his degree in Zoology. In addition, larval rearing trials done with moi larvae as a training exercise resulted in beneficial knowledge for local producer Hukilau Foods; data showed that there is no benefit to using copepod nauplii in raising moi larvae and, for that reason, further research is not being actively pursued unless the need arises, such as with an alternative fish species.

The "Pacific Regional Aquaculture Information Service for Education (PRAISE) & Publications" project is one that has been ongoing for years, yet it continues to improve and evolve its services and reach. Under the guidance of Kris Anderson, PRAISE has provided research support services ranging from development of educational products to direct delivery of research information. During its 9th project year, PRAISE received and responded to nearly 8,000 queries. For the relatively small investment CTSA made to fund this project, the Pacific region has access to information which has enabled users to apply successfully for grants, design better facilities, increase survival rates, produce quality merchandise, and market research results. Regional educators and librarians have also benefited through product development and resource sharing. The information dissemination activities under the Publications project, led by Meredith Brooks, have helped extend CTSA and other RAC research to industry stakeholders and interested parties throughout the region. The new YouTube video series has provided an opportunity for worldwide promotion of regional aquaculture activities, and the updated CTSA website features more information for farmers and an interactive map of the Center's region.

Click here to view the full report in PDF.

Moi Thyroid Project Update from the Oceanic Institute

Development of a practical Pacific threadfin (Polydactylus sexfillis) broodstock diet that improves broodstock health, reproductive output, and hatchery production

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The long-term investment by federal agencies such as CTSA and NOAA helped develop core hatchery and growout technologies for the highly popular Pacific threadfin (known locally as moi). This investment led to the startup of commercial moi production operations in Hawaii, and the first commercial open ocean fish farm in the United States. Current production methods have effectively supported large-scale fingerling production efforts for commercial cage operations for a number of years. However, a growing thyroid goiter condition has impacted valuable key broodstock populations, in turn threatening egg supplies and increasing operational costs.

Thyroid hormones are central regulators of growth, reproduction

Figure 1. Photograph of a large thyroid nodule at the based of the gills of a moi broodstock.

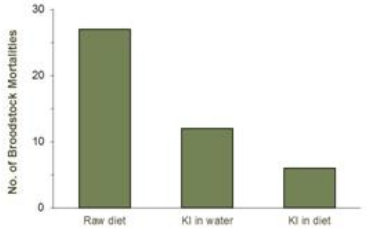

Figure 2. Reduction in broodstock mortality rates in response to iodide supplementation of tank water or diet.

and other metabolic processes. The two main thyroid hormones, thyroxin (T4) and triiodothyronine (T3) are produced in the thyroid gland, where iodide from food and water is incorporated into the chemical structure of these hormones.

During egg production, female broodstock deposit high levels of T3 and T4 into egg yolk to support embryonic and early larval development. Seawater wells often have low environmental iodide, leading to the unusually high-frequency of goiters in a range of shark (Crow 2008) and fish species including moi (Fig. 1).

Due to the central role of thyroid hormones in a wide array of physiological functions, the resulting thyroid insufficiency eventually causes the death of all affected stocks; creating a significant impediment for long-term breeding programs, and often targeting the most valuable of stocks. For our moi program, these chronic losses necessitate annual recruitment of new juveniles from wild stocks, followed by several years of stock maintenance as new recruits grow and mature through juvenile, male, and finally female stages (moi are protandrous hermaphrodites) to replace mature egg producing females.

Efforts to address this thyroid insufficiency through either dietary and tank water iodide supplementation reduced the frequency of goiter formation and improved overall broodstock survival rates (Fig. 2). Although the feeding of formulated diets supplemented with iodide was the easiest approach, the nutritional profile of available formulated diets (both commercial and in-house) led to reduced reproductive performance, necessitating a return to our standard frozen smelt, squid and shrimp-based dietary regimens to maintain necessary levels of reproductive output from stocks.

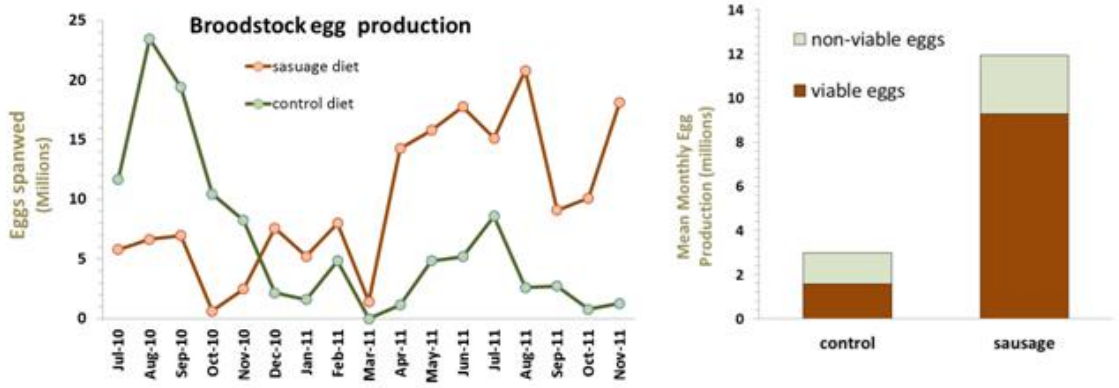

Figure 3. Monthly egg production of moi broodstock maintained on control diet, and an iodide- and vitamin-supplemented sausage diet.

In addition, the iodide- and vitamin-fortified sausage diet led to a four-fold increase in total egg production, averaging 12 million eggs per month, compared with 3 million eggs per month from the standard raw diet. Further, spawned eggs from the sausage diet fed stocks exhibited improved fertility (89% vs. 79%) and egg viability rates (63% vs. 49%) which effectively doubled again the

number of usable eggs for hatchery operations (Fig. 3).

Given the improvements in broodstock health and reproductive performance using the fortified sausage diet, the next step was to ensure that the new broodstock diet did not negatively influence the performance of the eggs in the hatchery. Somewhat surprisingly, the low egg thyroid hormone content in goitered broodstock (Witt 2008; Witt et al. 2009) had no measurable impacts on the hatchery performance of eggs or larvae. Even eggs derived from clearly goitered broodstock developed normally.

In more comprehensive hatchery trials, eggs from the iodide- and vitamin-treated stocks yielded a 38% improvement in hatch rate and similar (excellent) overall hatchery performance to the un-supplemented raw diet, with larval survival rates of 49.9% through to harvest and transfer to nursery. Added supplementation of the hatchery rearing water with potassium iodide also improved the hatch rate of eggs from non-iodide-supplemented broodstock, but led to a 40% decline in larval survival of the eggs from both control and sausage diet fed broodstock; clearly yielding no additional benefit to the hatchery rearing procedure.

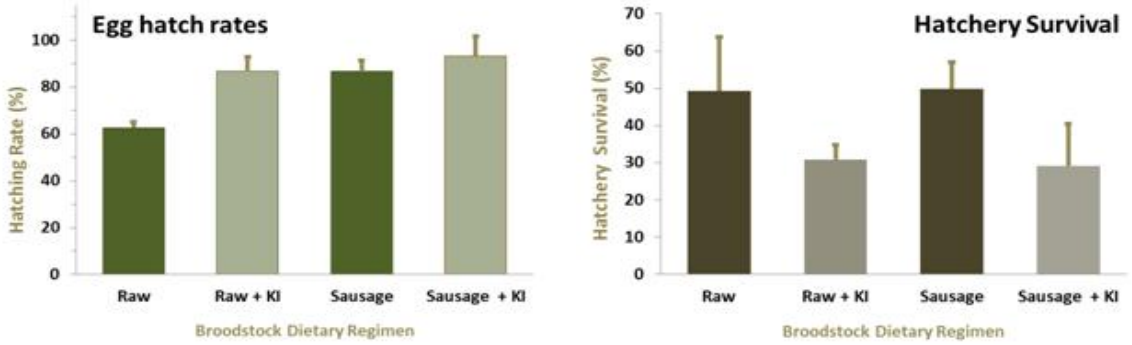

Figure 4. Effects of iodide-supplementation of broodstock diet (sausage) with, and without additional potassium iodide (KI) supplementation of the hatchery rearing water on egg hatch rates (left panel) and larval survival to harvest and transfer to nursery (right panel).

In summary, we successfully developed a practical dietary protocol for ensuring the long-term health and reproductive output of valuable moi broodstock. Through this project, we were able to address a long-standing health issue associated with maintaining broodstock in iodide deficient saltwater well water systems using an iodide-supplemented sausage diet preparation. The protocol increased the availability of viable eggs by over eight fold and substantially reduced attrition rates of highly prized fish stocks, valued at thousands of dollars per fish. In addition, eggs from the iodide- and vitamin-treated stocks showed a 38% improvement in hatch rate, with overall hatchery survival of 49.9% to harvest. These broodstock dietary procedures can be easily applied to other species of fish and allow considerable flexibility for adjustment and optimization of all broodstock dietary ingredients.

References:

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Witt, E.M. (2008) Effects of broodstock diet and environmental iodide concentrations on larval growth, survival, egg and whole body concentration of thyroid hormones and cortisol in Pacific threadfin, Polydactylus sexfilis. M.S. Thesis, University of Hawaii, 83pp.

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Marine Biology for their contributions in analyzing the thyroid hormone content of moi eggs, especially recognizing the important contributions of Mr. Eli Witt.

Pacific Island Spotlight: New Pacific Ocean Library is a Great Resource for Aquaculturists in the Pacific Region!

www.centerforoceansolutions.org

The Center for Ocean Solutions (COS) Pacific Ocean Library is a unique resource housing scientific articles, reports, government publications and gray literature on the Pacific Ocean's greatest threats, environmental and socioeconomic impacts, and potential solutions for the region. Designed for managers and researchers worldwide, regardless of affiliation, the library provides timely research and foundational readings on all aspects of these topics.

The Pacific Ocean Library emerged from an extensive literature review prepared for a group of scientists developing a Pacific Ocean Scientific Consensus Statement which prioritizes key threats to the health of the Pacific Ocean, highlights the impacts of these threats and outlines a road map for action. This statement-signed by 380 scientists around the world-is in turn part of a larger Pacific Ocean Initiative to sustainably manage this vast and complex region.

Click here to visit the Library.

AquaClip: Researchers Put Bass, Cobia, and Sea Bream on Vegetarian Diet

By Alex Dominguez, Associated Press, December 24, 2011.

Researchers say they may have overcome a roadblock in efforts to satisfy the world's growing demand for seafood through fish-farming.

While more fish are being farmed, taking pressure off wild stocks, environmentalists and fisheries experts are concerned that expanding current fish-farming methods will not be sustainable for many species because that would require more smaller fish to be caught for feed. And that can affect stocks of larger wild fish higher on the food chain.

Researchers at the Institute of Marine and Environmental Technology say they have developed a plant-based diet for three popular saltwater fish -- striped bass, cobia and Mediterranean sea bream. Taste-testers can't tell the difference between fish raised on the plant-based diet and those raised on fish meal, they say.

The two diets both contain fish oil, so neither was totally fish-free, but the researchers also raised fish on a vegetarian diet using wheat, corn, soy and algae meal to replace the oil. That raises the possibility of fish-free aquaculture for saltwater, carnivorous fish, said Aaron Watson, a graduate student at the institute.

"If we want to get aquaculture to expand, we need to find alternatives," Watson said.

Aquaculture for the first time this year accounted for more than half of global seafood consumption and is being looked at to keep up with increasing demand, said Tom Pickerell, senior science manager at Seafood Watch, a program at the Monterey Bay Aquarium that provides evidence-based recommendations on seafood consumption.

Click here to read the full article.

The Center for Tropical and Subtropical Aquaculture (CTSA) is one of five regional aquaculture centers in the United States established and funded by the U.S. Department of Agriculture's National Institute of Food and Agriculture (NIFA) under grants 2007-38500-18471, 2008-38500-19435, and 2010-38500-20948. The regional aquaculture centers integrate individual and institutional expertise and resources in support of commercial aquaculture development. CTSA was

established in 1986 and is jointly administered by the Oceanic Institute and the University of Hawaii.